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Complex seismic anisotropy beneath the IPOC stations of northern Chile

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The subduction of the Nazca plate beneath Central South America has been subject to numerous seismological studies. Here, we focus on seismic anisotropy which provides a direct link to the dynamic processes acting within the upper mantle and crust. The main mechanisms responsible for the development of large scale anisotropy are: i) crystallographic preferred orientation of upper mantle minerals and ii) shape-preferred orientation caused by cracks, melt-filled lenses or alternating layers within the crust. In this context, subduction zones represent a complex anisotropic puzzle as seismic anisotropy can be located in regions beneath, within, and above the subducting slab. We use the analysis of teleseismic shear-wave splitting to measure seismic anisotropy in response to subduction-related deformation processes. Previous studies on shear-wave splitting from South America have reported partly contradicting results and interpretations in terms of mantle flow and crustal deformation. Russo and Silver (1994) mostly found trench-parallel fast polarizations which they attributed to trench-parallel mantle flow beneath the slab and confined zones of oblique polarization directions. Wölbern et al. (2014) reported significant short-scale variations of fast polarization directions. They proposed that anisotropy results from fossil anisotropy in the subducting slab, whereas deviating fast polarizations in trench-parallel orientation were attributed to crustal anisotropy related to deep-reaching local shear zones. Long et al. (2016) found complex splitting measurements which they interpreted as the result of different anisotropic source regions. Overall, the complexity of splitting measurements yield a departure from a conventional 2D corner flow model. To investigate the upper mantle and crust in this subduction setting further, we use data from the Integrated Plate boundary Observatory Chile (IPOC) located in northern Chile, which consists of 21 stations with up to ten years of recording time. The stations cover an approximately 120 km wide coastal strip between 17.5° S and 24° S with an average station spacing of 60 km. The data allows for a thorough analysis of teleseismic events from different backazimuths and for constraining multiple anisotropic layer, if present. This will contribute further to understand the processes involved in the subduction as well as the contributions from different anisotropic source regions.